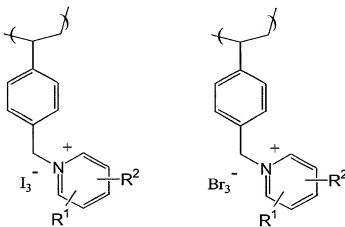


WHAT IS CLAIMED:

1. A water-insoluble polymeric medium having a plurality of polymerized N-pyridinium vinylbenzyl triiodide moieties whose pyridinium rings bear two substituents,  $R^1$  and  $R^2$ , that are independently a hydrido or a  $C_1$ - $C_4$  alkyl group, said polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties corresponding in structure to the formula



2. The polymeric medium in accordance with claim 1 wherein one of said  $R^1$  and  $R^2$  substituents is a  $C_1$  group.

3. The polymeric medium in accordance with claim 1 wherein said  $R^1$  and  $R^2$  substituents are both hydrido groups.

4. The polymeric medium in accordance with claim 1 that has a triiodide ion content of about 0.1 to about 1.0 moles per liter.

5. The polymeric medium in accordance with claim 1 that is free of water-elutable iodine.

6. A water-insoluble polymeric medium having a plurality of polymerized N-pyridinium vinylbenzyl triiodide moieties in which the triiodide ion content is about 0.1 to about 1.0 moles per liter, said medium being free of water-elutable iodine.

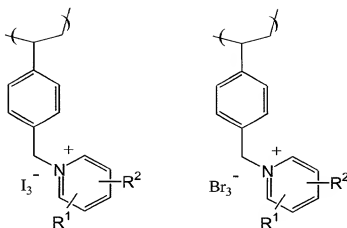
7. The polymeric medium in accordance with claim 6 wherein the triiodide ion content is about 0.2 to about 0.5 moles per liter.

8. The polymeric medium in accordance with claim 6 wherein said medium is macroreticular.

9. The polymeric medium in accordance with claim 8 wherein said macroreticular medium comprises free-flowing particles.

10. A process for forming an aseptic fluid from a fluid containing microbial contamination comprising the steps of:

(a) providing a vessel containing a water-insoluble polymeric medium having a plurality of polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties of the structure



wherein R<sup>1</sup> and R<sup>2</sup> are independently a hydrido or a C<sub>1</sub>-C<sub>4</sub> alkyl group;

(b) introducing to the vessel an influent of microbially contaminated fluid that is clear and free from visible precipitate to contact the insoluble medium;

(c) maintaining said fluid in contact with said insoluble medium for a time period sufficient for microbes present in the influent to be killed by said triiodide ions and form aseptic fluid; and

(d) discharging the aseptic fluid from the vessel as an effluent.

11. The process in accordance with claim 10 wherein one of said R<sup>1</sup> and R<sup>2</sup> substituents is a C<sub>1</sub> alkyl group.

12. The process in accordance with claim 10 wherein said R<sup>1</sup> and R<sup>2</sup> substituents are both hydrido groups.

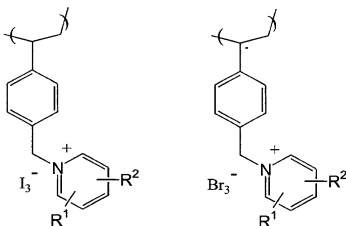
13. The process in accordance with claim 10 wherein said polymeric medium has a triiodide ion content of about 0.1 to about 1.0 moles per liter.



19. An apparatus for preparing an aseptic fluid that comprises:

a vessel having an inlet, an outlet and a water-insoluble polymeric medium in a polymeric medium-containing region;

said water-insoluble polymeric medium comprising a plurality of polymerized N-pyridinium vinylbenzyl triiodide moieties whose pyridinium rings bear two substituents,  $R^1$  and  $R^2$ , that are independently a hydrido or a  $C_1$ - $C_4$  alkyl group, said polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties corresponding in structure to the formula



wherein the medium is supported and contained within the medium-containing region.

20. The apparatus in accordance with claim 19 wherein one of said  $R^1$  and  $R^2$  substituents is a  $C_1$  group.

21. The apparatus in accordance with claim 19 wherein said  $R^1$  and  $R^2$  substituents are both hydrido groups.

22. The apparatus in accordance with claim 19 that has a triiodide ion content of about 0.1 to about 1.0 moles per liter.

23. The apparatus in accordance with claim 19 that is free of water-elutable iodine.

24. An apparatus for preparing aseptic water that comprises:

a vessel having an inlet, an outlet and a water-insoluble polymeric medium in polymeric medium-containing region;

said water-insoluble polymeric medium comprising a plurality of polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties in which the triiodide ion content is about 0.1 to about 1.0 moles per liter, and is free of water-elutable iodine;

wherein the medium is supported and contained within the medium-containing region.

25. The apparatus in accordance with claim 24 wherein the triiodide ion content is about 0.2 to about 0.5 moles per liter.

26. The apparatus in accordance with claim 24 wherein said medium is macroreticular.

27. The apparatus according to claim 24 wherein said vessel includes a first flow-permitting support positioned between the outlet and the medium-containing region.

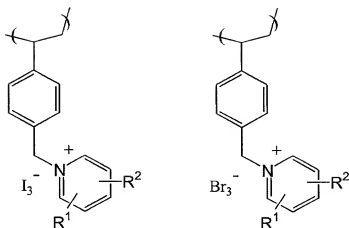
28. The apparatus according to claim 24 wherein said vessel includes a second flow-permitting support positioned between the inlet and the medium-containing region.

29. The separation apparatus according to claim 24 wherein said inlet and outlet are separated from each other.

30. The separation apparatus according to claim 24 wherein said the inlet and outlet are at opposite ends of the apparatus.

31. A process for oxidizing trivalent arsenic to pentavalent arsenic or trivalent antimony to pentavalent antimony comprising the steps of:

(a) providing a vessel containing a water-insoluble polymeric oxidizing medium having a plurality of oxidizing sites that comprise a plurality of polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties whose pyridinium rings bear two substituents,  $R^1$  and  $R^2$ , that are independently a hydrido or a  $C_1$ - $C_4$  alkyl group, said polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties corresponding in structure to the formula



(b) introducing an influent aqueous solution having trivalent arsenic or trivalent antimony to the vessel to contact the insoluble oxidizing medium;

(c) maintaining said solution in contact with said insoluble medium for a time period sufficient for said trivalent arsenic or trivalent antimony in the influent to react with said oxidizing sites to form a pentavalent arsenic-containing or pentavalent antimony-containing sample solution and a reduced medium; and

(d) separating the pentavalent arsenic-containing or antimony-containing sample solution from the reduced medium.

32. The process in accordance with claim 31 wherein one of said R<sup>1</sup> and R<sup>2</sup> substituents is a C<sub>1</sub> group.

33. The process in accordance with claim 31 wherein said R<sup>1</sup> and R<sup>2</sup> substituents are both hydrido groups.



34. The process in accordance with claim 31 wherein said separated pentavalent arsenic-containing sample solution is an effluent from said vessel.

35. The process in accordance with claim 31 wherein said pentavalent arsenic-containing sample solution is contacted with a pentavalent arsenic binding medium and that contact is maintained for a time period sufficient to form medium-bound pentavalent arsenic and an aqueous composition.

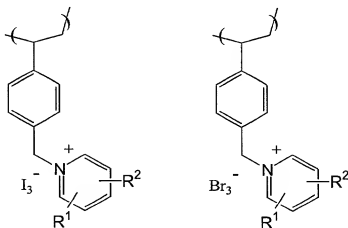
36. The process in accordance with claim 35 wherein said pentavalent arsenic binding medium and said oxidizing medium are in separate vessels.

37. The process in accordance with claim 36 wherein said aqueous composition is discharged from the vessel as an effluent having final arsenic concentration that is at least about 95 percent less than the initial arsenic concentration.

38. A process for removing trivalent arsenic from an aqueous solution comprising the steps of:

(a) providing a vessel containing a water-insoluble media comprising (i) an oxidizing medium having a plurality of oxidizing adsorption sites that are containing a water-insoluble polymeric oxidizing medium having a plurality of oxidizing sites that comprise a plurality of polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties whose pyridinium rings bear two substituents,  $R^1$  and  $R^2$ , that are independently a hydrido or a  $C_1$ - $C_4$  alkyl

group, said polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties corresponding in structure to the formula



and (ii) a pentavalent arsenic binding medium;

(b) introducing an influent aqueous solution having trivalent arsenic to the vessel to contact the insoluble oxidizing medium;

(c) maintaining said solution in contact with said insoluble oxidizing medium for a time period sufficient for said trivalent arsenic in the influent to react with said oxidizing sites to form an influent pentavalent arsenic-containing aqueous solution and for a time period sufficient for said formed pentavalent arsenic to bind to said binding sites to form a medium-bound arsenic and an aqueous composition; and

(d) discharging the aqueous composition from the vessel as an effluent having a final arsenic concentration of about zero to about 2 parts per billion.

39. The process in accordance with claim 38 wherein arsenic is present in said influent at a concentration greater than 50 parts per billion.

40. The process in accordance with claim 38 wherein said oxidizing medium and said pentavalent arsenic binding medium are present in said vessel in layers.

41. The process in accordance with claim 40 wherein said influent contacts said oxidizing medium layer prior to contacting said pentavalent arsenic binding medium layer.

42. Particulate alumina containing meta-periodate ions substantially homogeneously sorbed throughout the particles, wherein said meta-periodate ions are present in an amount of about 0.1 to about 0.15 molar in a gravity-settled volume of particles in deionized water.

43. A process for removing iron, manganese, mercury and cobalt ions from a water supply that comprises the steps of:

a) contacting an aqueous solution that contains one or more of iron, manganese, mercury and cobalt ions in a concentration greater than about 2 parts per billion with modified alumina particles, said modified alumina particles containing meta-periodate ions sorbed substantially homogeneously distributed throughout in an amount of about 0.05 to about 0.15 molar as measured in a gravity-settled volume of particles in deionized water;

b) maintaining said contact for a time period sufficient for the one or more of said iron, manganese, mercury and cobalt ions present to be sorbed by the particles to form particles containing one or more of iron, manganese, mercury and cobalt, and an aqueous solution having a lessened amount of one or more of iron, manganese, mercury and cobalt ions; and

c) separating said formed particles containing one or more of iron, manganese, mercury and cobalt from said aqueous solution having a lessened amount of iron, manganese, mercury and cobalt ions.

44. Particulate alumina containing iron substantially homogeneously sorbed throughout the particles, wherein said iron is present in an amount of about 0.1 to about 0.15 molar in a gravity-settled volume of particles in deionized water, said particles containing an oxidized iodine species and being substantially free of molecular iodine.

45. Particulate alumina containing manganese substantially homogeneously sorbed throughout the particles, wherein said manganese is present in an amount of about 0.05 to about 0.075 molar in a gravity-settled volume of particles in deionized water, said particles containing an oxidized iodine species and being substantially free of molecular iodine.

46. A process for removing arsenic or antimony +3 or +5 ions from a water supply that comprises the steps of;

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a) contacting an aqueous solution that contains arsenic or antimony +3 or +5 ions in a concentration greater than about 2 parts per billion with modified alumina particles, said modified alumina particles containing iron or manganese or both sorbed substantially homogeneously distributed throughout in an amount of about 0.05 to about 0.15 molar as measured in a gravity-settled volume of particles in deionized water, said particles also containing an oxidized iodine species and being substantially free of molecular iodine;

b) maintaining said contact for a time period sufficient for arsenic or antimony +3 or +5 ions present to be sorbed by the particles to form arsenic- or antimony-containing particles and an aqueous solution having a lessened amount of arsenic or antimony; and

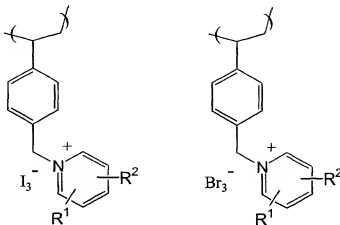
c) separating said arsenic- or antimony-containing particles from said aqueous solution having a lessened amount of arsenic or antimony.

47. The process according to claim 46 wherein said particles are modified with iron, and said iron is present in an amount of about 0.10 to about 0.15 molar.

48. The process according to claim 46 wherein said particles are modified with manganese, and said manganese is present in an amount of about 0.05 to about 0.075 molar.

49. The process according to claim 46 wherein prior to step (a), said aqueous solution is contacted with a water-insoluble polymeric medium

having a plurality of polymerized N-pyridinium vinylbenzyl triiodide or tribromide moieties of the structure



wherein R<sup>1</sup> and R<sup>2</sup> are independently a hydrido or a C<sub>1</sub>-C<sub>4</sub> alkyl group;

maintaining said solution in contact with said insoluble medium for a time period sufficient for said trivalent arsenic or trivalent antimony in the influent to react with said oxidizing sites to form a pentavalent arsenic-containing or pentavalent antimony-containing sample solution and a reduced medium;

separating the pentavalent arsenic-containing or antimony-containing sample solution from the reduced medium; and

using the separated pentavalent arsenic-containing or antimony-containing sample solution as said aqueous solution of step (a).

50. The process in accordance with claim 49 wherein said R<sup>1</sup> and R<sup>2</sup> substituents are both hydrido groups.